driving the second stage in the first direction to prevent a positional error between said first stage and said second stage at least when the first stage is being at least one of accelerated and decelerated.

REMARKS

Claims 26-94 and 97-104 are pending. By this Amendment, claims 29-34, 37-42, 45, 53, 54, 58, 59, 65-68, 70-73, 75, 76, 79, 80, 82, 83, 87 and 88 are amended. The attached Appendix includes a marked-up copy of each rewritten claim (37 C.F.R. §1.121(c)(1)(ii)).

I. Status of Inventorship Correction

A Request to Amend Inventorship, due to the cancellation of non-elected claims, was filed with the other papers on December 12, 2000. The January 26 Office Action, however, did not reference the Request to Amend Inventorship. The Examiner is requested to confirm that the inventorship has been amended, such that Hiroto HORIKAWA is identified as the sole inventor, in the next Patent Office communication.

II. All Pending Claims are Patentable

Claims 26-94 and 97-104 stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,477,304 to Nishi in view of U.S. Patent No. 4,916,340 to Negishi. This rejection is respectfully traversed.

With respect to independent claim 26, Nishi and Negishi do not disclose or suggest the cooling of an actuator driving a fine adjustment stage by circulating the cooling fluid from a portion near an optical path of the light beam from an interferometer as recited in independent claim 26. The Office Action fails to even address this feature. In addition, and as recognized in the Office Action, neither reference discloses a system for cooling the actuators of a fine adjustment stage. Accordingly, Applicant respectfully submits that independent claim 26, as well as its dependent claims, are patentable over Nishi and Negishi.

Independent claim 46 recites that an actuator drives the fine adjustment stage in a scanning direction, that an actuator drives the fine adjustment stage in a direction perpendicular to the scanning direction, and that the cooling unit cools the actuators by circulating a cooling fluid from the actuators arranged in the direction perpendicular to the scanning direction. Neither Nishi nor Negishi discloses or suggests such a direction for circulating the cooling fluid. The Office Action fails to address this feature. In addition, as noted above, neither reference discloses or suggests providing a cooling unit for the actuators of a fine adjustment stage. Accordingly, Applicant submits that independent claim 46 and its dependent claims are patentable over the references.

Regarding independent claim 30, neither Nishi nor Negishi discloses or suggests the claimed first actuator having a first coil member and a first magnetic member, combined with the claimed second actuator having the claimed second coil member and second magnetic member, along with the claimed first and second thrusts. Similarly, regarding independent claim 38, neither reference discloses or suggests the claimed first linear motor and second linear motor having the claimed first and second thrusts. Accordingly, claims 30, 38 and their dependent claims are patentable over the applied references.

With respect to independent claims 54, 59, 66, 71, 76, 83 and 88, the Office Action relies upon the feature of Nishi in which a reticle fine adjustment stage 21 is reset to an initial position while the reticle side scanning stage 20 is decelerated. Nonetheless, Applicant respectfully submits that neither Nishi nor Negishi, taken alone or combined, discloses or suggests the combination of features recited in these claims. In particular, the references do not disclose or suggest driving the first actuator in order to prevent positional error of the mask, as recited in claims 54 and 83, or so as to prevent positional error between the first and second stages, as recited in claims 71, 76 and 88. In addition, the references do not disclose or suggest driving the fine adjustment stage in order to prevent positional error between the scanning stage and the fine

adjustment stage as recited in independent claim 59. Furthermore, the references do not disclose the claimed actuator having a first part connected to the first stage and a second part connected to the second stage as recited in independent claims 66, 71 and 76.

Accordingly, Applicant respectfully submits that independent claims 54, 59, 66, 71, 76, 83 and 88, as well as their dependent claims, are patentable over the applied references.

III. Conclusion

In view of the foregoing, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited.

Should the Examiner believe anything further would be desirable to place this application in even better condition for allowance, the Examiner is invited to contact Applicant's undersigned attorney at the telephone number listed below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

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JAO:MAC/slm

Attachments:
Appendix
Petition for Extension of Time
Request for Continued Examination

Date: June 26, 2001

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Claims:

Claims 29-34, 37-42, 45, 53, 54, 58, 59, 65-68, 70-73, 75, 76, 79, 80, 82, 83, 87 and 88 are amended.

The following is a marked-up version of each amended claim:

29. (Amended) An apparatus according to claim 26, wherein at least one of said actuators is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

30. (Amended) A stage apparatus comprising:

a first stage that is movable linearly in a first direction;

a second stage that is movable in said first direction and in a second direction perpendicular to said first direction with respect to said first stage;

a first actuator ~~that drives~~ having a first coil member and a first magnetic member to drive said second stage with a second thrust in said second direction with respect to said first stage; and

a second actuator ~~that drives~~ having a second coil member and a second magnetic member to drive said second stage with a first thrust in said first direction with respect to said first stage, said first thrust being larger than said second thrust.

31. (Amended) An apparatus according to claim 30, wherein said first actuator is an electromagnetic actuator of a moving magnet type, and ~~a stationary member having a coil~~ said first coil member of said first actuator is fixed to said first stage.

32. (Amended) An apparatus according to claim 30, wherein said second actuator is an electromagnetic actuator of a moving magnet type, and ~~a stationary member having a coil~~ said second coil member of said second actuator is fixed to said first stage.

33. (Amended) An apparatus according to claim 31, further comprising a cooling unit that cools said ~~stationary~~ first coil member of said first actuator by circulating a cooling fluid.

34. (Amended) An apparatus according to claim 32, further comprising a cooling unit that cools said ~~stationary~~ second coil member of said second actuator by circulating a cooling fluid.

37. (Amended) An apparatus according to claim 30, wherein at least one of said first and second actuators is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

38. (Amended) A stage apparatus comprising:

a first stage that is movable linearly in a first direction;

a second stage that is movable in said first direction and in a second direction perpendicular to said first direction with respect to said first stage;

a first actuator ~~that drives~~ having a first linear motor to drive said second stage with a second thrust in said second direction with respect to said first stage; and

a second actuator ~~that drives~~ having a second linear motor to drive said second stage with a first thrust in said first direction with respect to said first stage, said first thrust being different from said second thrust.

39. (Amended) An apparatus according to claim 38, wherein said first actuator is an electromagnetic actuator of a moving magnet type, and ~~a stationary member having a coil~~ a first coil member of said first actuator is fixed to said first stage.

40. (Amended) An apparatus according to claim 38, wherein said second actuator is an electromagnetic actuator of a moving magnet type, and a ~~stationary member having a coil~~ second coil member of said second actuator is fixed to said first stage.

41. (Amended) An apparatus according to claim 39, further comprising a cooling unit that cools said ~~stationary~~ first coil member of said first actuator by circulating a cooling fluid.

42. (Amended) An apparatus according to claim 40, further comprising a cooling unit that cools said ~~stationary~~ second coil member of said second actuator by circulating a cooling fluid.

45. (Amended) An apparatus according to claim 38, wherein at least one of said first and second actuators is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

53. (Amended) An apparatus according to claim 46, wherein at least one of said actuators is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

54. (Twice Amended) A lithographic device comprising in a following order:

a substrate stage that is positionable by a first positioning device parallel to a first direction in order to position a substrate;

an imaging system having a main axis directed parallel to a vertical direction perpendicular to the first direction;

a mask stage that is positionable at least parallel to the first direction by a second positioning device in order to position a mask; and

an illumination optical system that irradiates an exposure illumination light beam;

wherein the second positioning device includes a first actuator that positions the mask stage over a comparatively small movement parallel to the first direction, and a second actuator that positions the mask stage over a comparatively large movement parallel to the first direction, the first actuator being driven to prevent a positional error of the mask at least when the second actuator is being at least one of accelerated and decelerated.

58. (Amended) A device according to claim 54, wherein said first actuator is an electromagnetic actuator constituted by a pair of subactuators which are parallellyparellelly arranged.

59. (Amended) A scanning exposure apparatus that moves a mask with respect to a projection optical system while illuminating said mask on which a transfer pattern is formed and synchronously moves a photosensitive substrate with respect to said projection optical system, thereby projecting and exposing said pattern on said mask onto said substrate through said projection optical system, comprising:

a base that holds the following elements;

a scanning stage that is movable, with respect to said base, along a first direction corresponding to a moving direction of said mask and said substrate;

a fine adjustment stage that is movable along the first direction with respect to said scanning stage, said fine adjustment stage mounting one of said mask and said substrate; and

an actuator that drives said fine adjustment stage to prevent a positional error between said scanning stage and said fine adjustment stage at least when said scanning stage is being at least one of accelerated and decelerated during a scanning exposure operation.

65. (Amended) An apparatus according to claim 59, wherein said actuator is constituted by a pair of subactuators which are parellelly parallelly arranged.

66. (Amended) A stage apparatus comprising:

a first stage that is linearly movable in a first direction;

a second stage that is movable in said first direction with respect to said first stage; and

an actuator that drives said second stage in said first direction, said actuator driving said second stage at least when said first stage is being at least one of accelerated and

decelerated, said actuator having a first portion connected to said first stage and a second portion connected to said second stage.

67. (Amended) An apparatus according to claim 66, wherein said actuator is an electromagnetic actuator of a moving magnet type, and ~~a stationary member~~ said first portion having a coil ~~of said electromagnetic actuator is fixed to said first stage~~.

68. (Amended) An apparatus according to claim 67, further comprising a cooling unit that cools said ~~stationary member~~ first portion of said electromagnetic actuator by circulating a cooling fluid.

70. (Amended) An apparatus according to claim 66, wherein said actuator is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

71. (Amended) A stage driving method for driving, in a predetermined direction, a first stage that is arranged to be movable linearly in a first direction and for driving a second stage that is arranged to be movable at least in said first direction with respect to said first stage, comprising the steps of:

providing an actuator to drive said second stage, said actuator having a first portion connected to said first stage and a second portion connected to said second stage;

driving said first stage; and

driving said second stage to prevent a positional error between said first stage and said second stage at least when said first stage is being at least one of accelerated and decelerated.

72. (Amended) A method according to claim 71, wherein said second stage is driven by an electromagnetic actuator of a moving magnet type, and said first portion~~a stationary member~~ having a coil ~~of said electromagnetic actuator is fixed to said first stage~~.

73. (Amended) A method according to claim 72, further comprising the step of cooling said stationary member of said ~~electromagnetic actuator~~ first portion by circulating a cooling fluid.

75. (Amended) A method according to claim 71, wherein an electromagnetic actuator that drives said second stage is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

76. (Amended) A stage driving method for scanning an object that includes at least one of a mask and a photosensitive substrate, in a scanning exposure apparatus that illuminates said mask on which a transfer pattern is formed and scans said mask in a predetermined scanning direction and synchronously scans said substrate in a direction corresponding to said scanning direction, thereby exposing said pattern onto said substrate, said method comprising the steps of:

driving a first stage in said scanning direction, said first stage being used for scanning one of said mask and said substrate; and

driving a second stage in said scanning direction by an actuator having a first portion connected to said first stage and a second portion connected to said second stage to prevent a positional error between said first stage and said second stage at least when said first stage is being at least one of accelerated and decelerated during said scanning exposure, said second stage being movable in said scanning direction with respect to said first stage, and said second stage mounting said object thereon.

79. (Amended) A method according to claim 76, wherein ~~an electromagnetic actuator that drives said second stage~~ said actuator is of a moving magnet type, and ~~a stationary member~~ said first portion having a coil ~~of said electromagnetic actuator is fixed to said first stage~~.

80. (Amended) A method according to claim 79, further comprising the step of cooling said ~~stationary member of said electromagnetic actuator~~ first portion by circulating a cooling fluid.

82. (Amended) A method according to claim 76, wherein said actuator is~~second stage is driven by~~ an electromagnetic actuator that is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

83. (Amended) A method for making an exposure apparatus that transfers a pattern of a mask onto a substrate, comprising the steps of:

providing a substrate stage on which said substrate is mounted;

providing a first positioning device that positions said substrate stage parallel to a first direction;

providing an imaging system having a main axis directed parallel to a vertical direction and perpendicular to the first direction;

providing a mask stage on which said mask is mounted;

providing a second positioning device that positions said mask stage at least parallel to the first direction; said second positioning device having a first actuator that positions said mask stage over a comparatively small movement parallel to the first direction, and a second actuator that positions said mask stage over a comparatively great movement parallel to the first direction, the first actuator being driven at least to prevent a positional error of said mask when the second actuator is being at least one of accelerated and decelerated; and

providing an illumination optical system that irradiates an exposure illumination light beam.

87. (Amended) A method according to claim 83, wherein said first actuator is constituted by a pair of subactuators which are ~~parellelly~~ parallelly arranged.

88. (Amended) A method of operating an exposure apparatus to transfer a pattern on a mask onto a substrate, the apparatus having a projection optical system, a first stage that is movable along a first direction with respect to the projection optical system, and a second stage that is movable along the first direction with respect to the first stage, the second stage mounting one of said mask and said substrate thereon, the method comprising the steps of:

driving the first stage in the first direction; and

driving the second stage in the first direction to prevent a positional error between said first stage and said second stage at least when the first stage is being at least one of accelerated and decelerated.